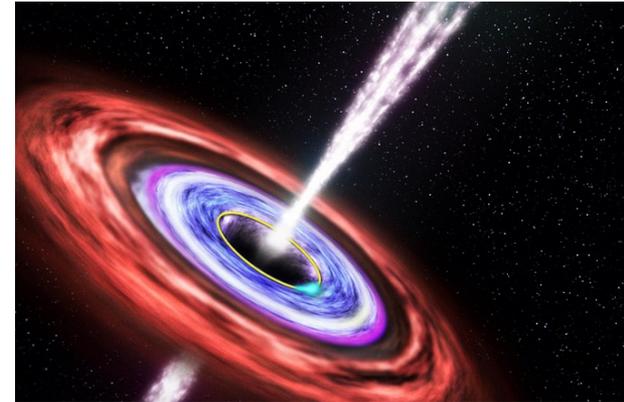
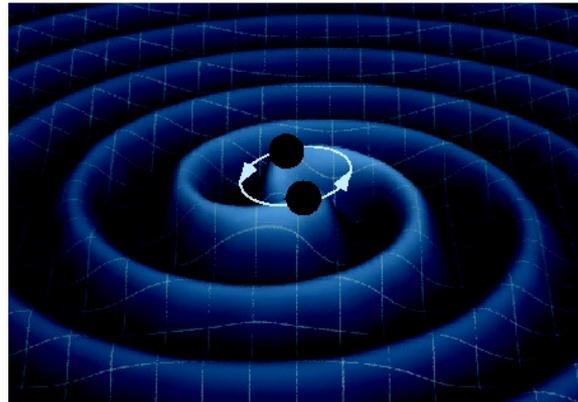
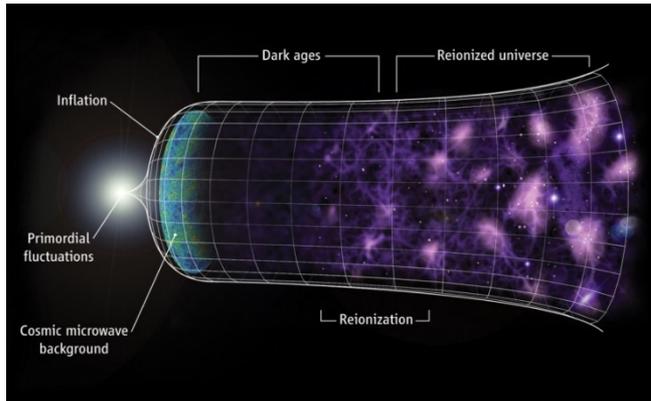
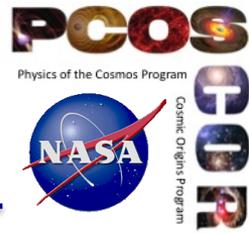


# Overview of the Physics of the Cosmos Program Analysis Group



**Ryan C. Hickox**

Dartmouth College  
*Chair, Physics of the Cosmos Program Analysis Group, PhysPAG*  
*ryan.c.hickox@dartmouth.edu*

*PCOS/PhysPAG Town Hall, APS April Meeting, 17 April 2021*

# Outline

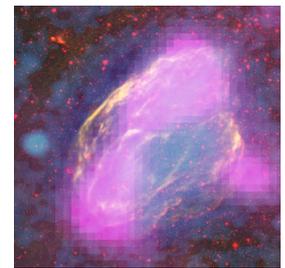
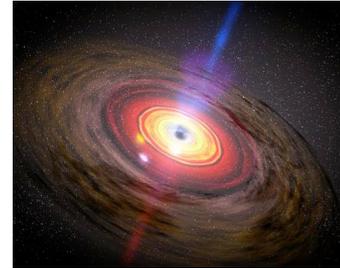
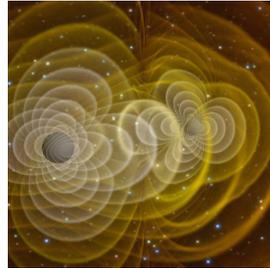
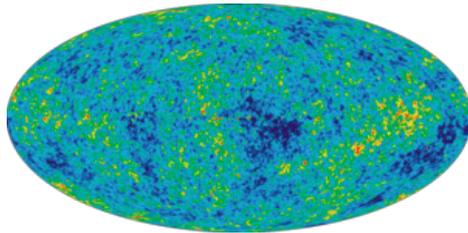
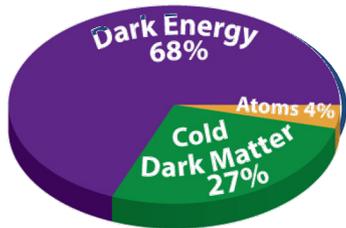
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- **Introduction to PhysPAG**
- **Science Interest Groups (SIGs) and Science Analysis Groups (SAGs) and activities at APS**
- **Cross-PAG initiatives**
- **Overview of this session**

## **PCOS-related activities at APS:**

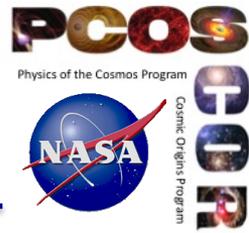
[https://pcos.gsfc.nasa.gov/phypag/meetings/APS\\_2021/PCOS\\_Related\\_Activities\\_Apr2021APS.php](https://pcos.gsfc.nasa.gov/phypag/meetings/APS_2021/PCOS_Related_Activities_Apr2021APS.php)

# Physics of the Cosmos Science Objectives



- Increase our knowledge of dark energy
- Precisely measure cosmological parameters governing evolution of the universe and test inflation hypothesis of Big Bang
- Test validity of Einstein's General Theory of Relativity and investigate nature of spacetime
- Understand formation and growth of massive black holes and their role in evolution of galaxies
- Explore behavior of matter and energy in its most extreme environments

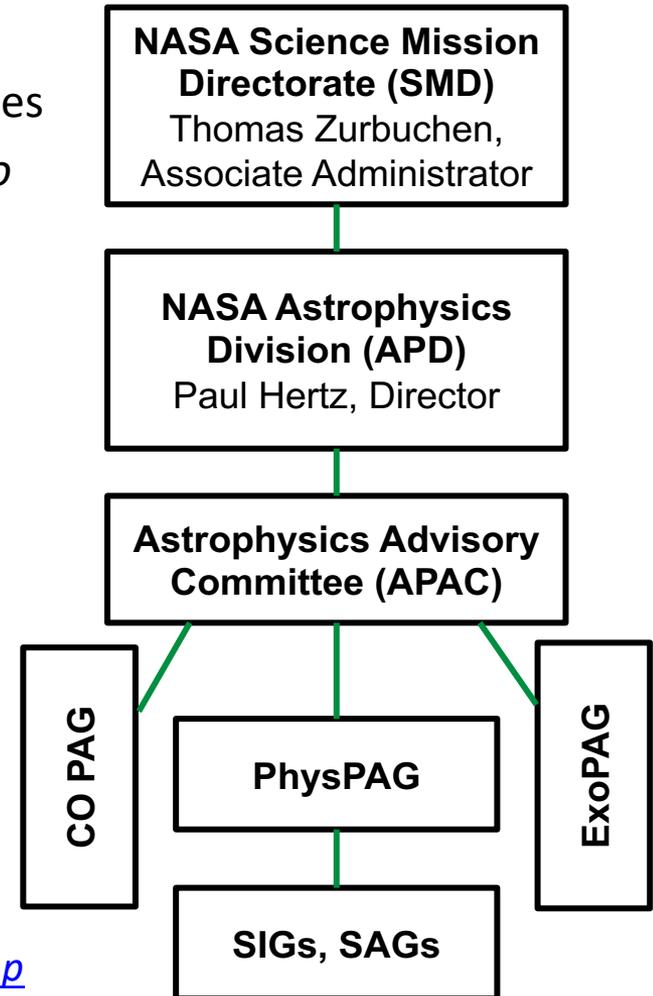
# Physics of the Cosmos Program Analysis Group



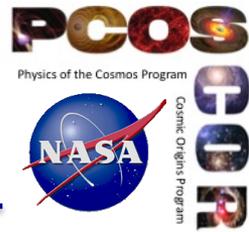
## Purpose:

- provide input to NASA relevant to PCOS
- help NASA inform interested parties about PCOS activities
- **Membership: *You!*** *Anyone interested in providing input to NASA relevant to its Physics of the Cosmos Program*
- **Leadership:**
  - **Executive Committee (EC):**
    - Chair Emeritus: Graça Rocha
    - Chair: Ryan Hickox
    - Vice Chair: Grant Tremblay
  - 11 EC members chair 6 Science Interest Groups (**SIGs**): longer-standing discipline-specific
  - support formation of Science Analysis Groups (**SAGs**): group created to analyze a specific science question
  - facilitate **info flow** between NASA and community

For more info: <https://pcos.gsfc.nasa.gov/physpag/physpag-ec.php>



Annual call again this fall!



# PhysPAG EC Membership

Name	Affiliation	Area of Expertise	Term Ends
Graça Rocha (Chair Emeritus)	JPL/Caltech	GW SIG	Dec 2021
Ryan Hickox (Chair)	Dartmouth College	XR SIG	Dec 2021
Marcos Santander	Univ. of Alabama	CR SIG / GR SIG	Dec 2021
Jillian Bellovary	Queensborough Comm Coll.	GW SIG / XR SIG	Dec 2022
Sean McWilliams	WVU	GW SIG	Dec 2022
Bindu Rani	SURA, GSFC	GR SIG	Dec 2022
Grant Tremblay (Vice-Chair)	SAO	XR SIG	Dec 2022
Justin Finke	NRL	GR SIG	Dec 2023
Vera Glusevic	Univ. of Southern California	CoS SIG	Dec 2023
Andres Romero-Wolf	JPL	CR SIG	Dec 2023

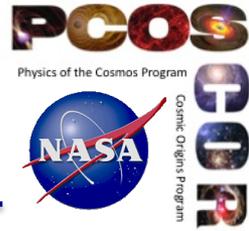


\* New Roles



\*New members as of 2021

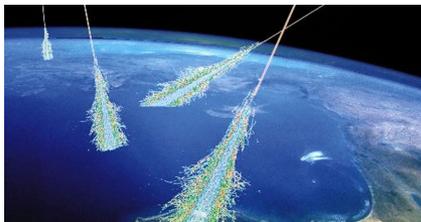
# Science Interest Groups (SIGs)



## Science Interest Groups (SIGs)

- **Inflation Probe** (IP SIG) (Chairs: Kevin Huffenberger and Graça Rocha): Coordinate community activities and preparations for a future cosmic microwave background polarization mission.
- **Gravitational Wave** (GW SIG) (Chairs: Jillian Bellovary and Sean McWilliams): Coordinate community activities and preparations for a future gravitational wave mission.
- **X-ray** (XR SIG) (Chairs: Ryan Hickox, Jillian Bellovary, and Grant Tremblay): Coordinate community activities and preparations for a future X-ray astronomy mission.
- **Gamma Ray** (GR SIG or GammaSIG) (Chairs: Marcos Santander, Bindu Rani, and Justin Finke): Coordinate community activities and preparations for a future gamma ray astronomy mission.
- **Cosmic Ray** (CR SIG) (Chairs: Marcos Santander and Andrew Romero-Wolf): Coordinate community activities and preparations for a future cosmic ray astronomy mission.
- **Cosmic Structure** (CoS SIG) (Chairs: Kevin Huffenberger, Graça Rocha, and Vera Gluscevic): Coordinate community activities for future space activities concerning the nature of dark energy, dark matter, neutrinos, and tests of inflation, as well as astrophysical galaxy evolution.

# Cosmic Ray SIG



## Cosmic Ray SIG Minisymposium (Session D21)

**Sponsoring Division:** DAP

**When:** Saturday 17 April 2021, 2:30 PM Eastern/1:30 PM Central/12:30 PM Mountain/11:30 AM Pacific

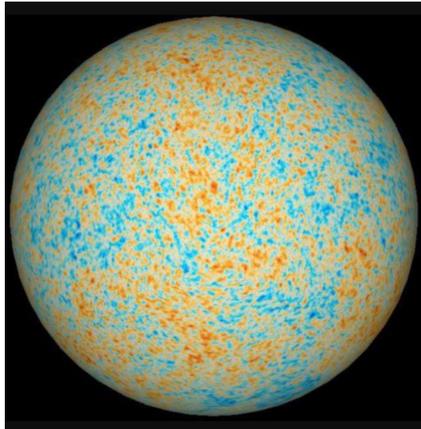
**Chair:** Marcos Santander (U. Alabama)

### Agenda

**ALL TIMES GIVEN FOR TALKS ARE CENTRAL DAYLIGHT TIME**

- 1:30– Marcos Santander (U. Alabama) – Welcome and Introduction to the CR-SIG  
1:35
- 1:35– Frank Schroeder (U. Delaware) – Ultra-high-energy Cosmic Rays: Recent Results  
2:10 and Future Plans
- 2:10– Andres Romero-Wolf (NASA JPL) – Particle Astrophysics at Zettavolt Energies with  
2:27 Radio Detectors in Low Lunar Orbit
- 2:27– Remy Prechelt (U. Hawaii) – Prowling for Ultrahigh Energy Neutrinos with PUEO  
2:44
- 2:44– Lawrence Wiencke (Colorado School of Mines) – The EUSO-SPB2 Mission  
3:01
- 3:01– Angela V. Olinto (U. Chicago) & John Krizmanic (NASA GSFC) – The Roadmap to  
3:18 the POEMMA Mission

# Inflation Probe SIG



## Inflation Probe SIG Minisymposium (Session K21)

**Sponsoring Division:** DAP

**When:** Sunday 18 April, 2:30 PM Eastern/1:30 PM Central/12:30 PM Mountain/11:30 AM Pacific

**Chair:** Kevin Huffenberger (Florida State U.)

### Agenda

**ALL TIMES GIVEN FOR TALKS ARE CENTRAL DAYLIGHT TIME**

- 1:30– Graça Rocha (NASA JPL) – Inflation Probe SIG Overview [[PDF](#)]
- 1:37
- 1:37– Shaul Hanany (U. Minnesota) – Science Reach of PICO – a New, Probe-Class CMB
- 1:53 Space Mission
- 1:53– Adrian Lee (UC Berkeley) – LiteBIRD Overview
- 2:09
- 2:09– Al Kogut (NASA GSFC) – The Primordial Inflation Polarization Explorer (PIPER):
- 2:25 Testing Inflation on Large Angular Scales
- 2:25– Jeff Filippini (U. Illinois) – The First Flight of SPIDER: Probing Inflation from the
- 2:41 Stratosphere
- 2:41– Discussion
- 2:46
- 2:46– Mathieu Remazeille (U. Manchester) – Forecasts on Foregrounds Removal and
- 2:53 CMB B-mode Recovery with the Probe-class Mission Concept PICO
- 2:53– Rahul Datta (Johns Hopkins) – The Primordial Inflation Polarization Explorer
- 3:00 (PIPER): Characterization of the Receiver and Detector Arrays
- 3:00– Johanna Nagy (Wash. U. St Louis) – Foreground Component Separation for
- 3:07 SPIDER's Primordial B-mode Constraint [[PDF](#)]
- 3:07– TBA – LiteBIRD related
- 3:14
- 3:14– Discussion
- 3:18

# Gamma Ray SIG



## Gamma Ray SIG Minisymposium (Session L21)

**Sponsoring Division:** DAP

**When:** Sunday 18 April, 4:45 PM Eastern/3:45 PM Central/2:45 PM Mountain/1:45 PM Pacific

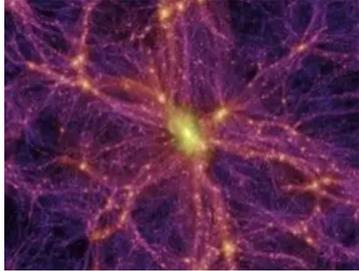
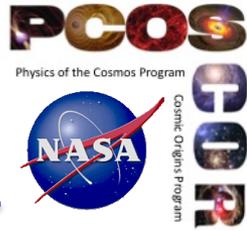
**Chair:** Bindu Rani (NASA GSFC)

## Agenda

### ALL TIMES GIVEN FOR TALKS ARE CENTRAL DAYLIGHT TIME

- 3:45– Bindu Rani (NASA GSFC) – Gamma Ray SIG Overview  
3:50
- 3:50– Dave Thompson (NASA GSFC) – Maximizing the Scientific Return of the Time  
4:14 Domain Astronomy
- 4:14– Raffaella Margutti (Northwestern U.) – Gamma-ray Novae  
4:38
- 4:38– Jamie Holder (U. Delaware) – Gamma-ray Transients  
5:02
- 5:02– Elias Aydi (Michigan State U.) – Gamma-ray Binaries  
5:26
- 5:26– Open Discussion  
5:33

# Cosmic Structure SIG



## Cosmic Structure SIG Minisymposium (Session Q21)

**Sponsoring Division:** DGRAV

**When:** Monday 19 April, 11:45 AM Eastern/10:45 AM Central/9:45 AM Mountain/8:45 AM Pacific

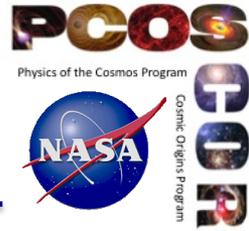
**Chair:** Graça Rocha (NASA JPL)

## Agenda

### ALL TIMES GIVEN FOR TALKS ARE CENTRAL DAYLIGHT TIME

- 10:45–10:55 Kevin Huffenberger (Florida State U.) – Update on Cosmic Structure SIG
- 10:55–11:25 Elisabeth Krause (U. Arizona) – Update on SPHEREx
- 11:25–11:55 Kris Pardo (NASA JPL) – Update on Roman Space Telescope
- 11:55–12:33 Open Discussion

# X-ray SIG



## X Ray SIG Minisymposium (Session S21)

**Sponsoring Division:** DGRAV

**When:** Monday 19 April, 2:30 PM Eastern/1:30 PM Central/12:30 PM Mountain/11:30 AM Pacific

**Chair:** Grant Tremblay (Harvard)

## Agenda

### ALL TIMES GIVEN FOR TALKS ARE CENTRAL DAYLIGHT TIME

- 1:30– Ryan Hickox (Dartmouth) – Introduction to XRSIG and highlights in X-ray astronomy
- 1:42– Sharon Morsink (U. Alberta) – The Neutron Star Equation of State with NICER
- 2:06– Mengjiao Xiao (MIT) – Constraints on Axionlike Particles from a Hard X-Ray Observation of Betelgeuse
- 2:30– Dominic Sicilian (U. Miami) – X-ray Constraints on Sterile Neutrino Dark Matter
- 2:54– Grant Tremblay (Harvard), Jillian Bellovary (CUNY QCC), and Ryan Hickox (Dartmouth) – Open Business and Discussion

# Cross-PAG Initiatives

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PhysPAG, COPAG, and ExoPAG are collaborating on multiple cross-PAG initiatives:

- **Expanding Participation in NASA Astrophysics at Under-Resourced Institutions**

Led by Jillian Bellovary (XRSIG and GWSIG Co-Chair). Exploring a potential SAG: Draft terms of reference have been presented to the APAC and discussions are ongoing. Feedback welcome – please contact us if you'd like to contribute!

- Also discussions on **cross-cutting technologies** and **data analysis frameworks**

Consensus is that these efforts will be most effective after the publication of the Astro2020 Decadal Survey results



## FEDERAL REGISTER

The Daily Journal of the United States Government



 Notice

# Request for Information Related to High Energy Physics and Space-Based Astrophysics

A Notice by the [Energy Department](#) on 01/21/2021

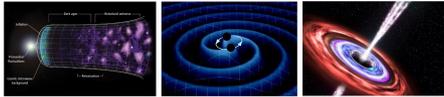


**Focus Area 1:** physics with lunar surface or orbital platforms

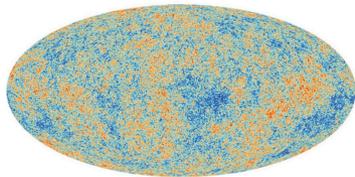
**Focus Area 2:** physics with the International Space Station platform

**Focus Area 3:** dark energy science with Vera Rubin Observatory, Roman Space Telescope, and Euclid

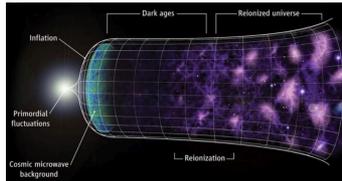
# Overview of this session



**Overview of PCOS and PhysPAG** – Brian Williams and Ryan Hickox



**Unveiling the Early Universe with the Spectral Distortions of the CMB** – Joe Silk (IAP & JHU) (20+4 mins)



**Extending the Cosmic Frontier into the Dark Ages** – Joseph Lazio (NASA JPL) (20+4 mins)



**A Lunar Farside Low Radio Frequency Array for Dark Ages 21-cm Cosmology** – Jack Burns (Univ. of Colorado) (20+4 mins)



**The Once & Future Great Observatories** – Grant Tremblay (SAO; PhysPAG EC Vice Chair) (10+2 mins)